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MAGSAT PROGRAM

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Investigation Number M-41

THE REDUCTION, VERIFICATION AND INTERPRETATION  
OF MAGSAT MAGNETIC DATA OVER CANADA

R.L. Coles, Principal Investigator

Co-investigators: G.V. Haines

G. Jansen van Beek

J.K. Walker

L.R. Newitt

Computing Advisor: A. Nandi

Geomagnetic Service  
Earth Physics Branch  
Energy, Mines and Resources Canada  
1 Observatory Crescent  
Ottawa, Ontario, Canada  
K1A 0Y3

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## I

### INTRODUCTION

This investigation is primarily concerned with studies of the magnetic field originating in the solid earth, as measured by Magsat. Most of this field originates in the core, but an important part is of lithospheric origin. The magnetic anomalies from the lithosphere are weak, and are easily masked by large effects caused by currents flowing in the ionosphere and magnetosphere, particularly at high latitudes.

However, statistical screening techniques have enabled preliminary magnetic anomaly scalar and vector maps for high northern latitudes to be produced, and some correlations with earth structures have been made.

## II

### TECHNIQUES

Research into a new approach for altitude adjustments using a harmonic functional representation is in progress and will be reported on in due course.

## III & IV

### ACCOMPLISHMENTS and SIGNIFICANT RESULTS

Correlations between the Magsat scalar anomaly map produced at the Earth Physics Branch and other geophysical and geological data have been made. A summary presentation of these was given at the 4th Annual Geodynamics meeting at GSFC in January 1982.

Correlations between high magnetic field and some high metamorphic grade shields are seen (e.g., northern Quebec, the western Canadian Shield, Anabar Shield, north Greenland), as are correlations between low magnetic field and shield regions of lower metamorphic grade (e.g., central Superior Province, parts of Baltic Shield).

An intriguing contrast exists between the broad low anomaly field over the Nansen-Gakkel Ridge (a spreading plate margin) and the high anomaly field over Iceland (again part of a spreading margin). Both regions have high heat flow, and presumably thin magnetic crust. This indicates that Iceland is quite anomalous in its magnetic character, and possible similarities with the Alpha Ridge are suggested. However, the strong similarities between the high anomaly over the Alpha Ridge and those over high-grade shield regions, including northern Greenland, still support the idea of a continental nature for the Alpha Ridge.

Interesting correlations exist between Magsat anomalies around the North Atlantic after reconstructing the fit of continents into a pre-rifting configuration. These correlations suggest that the several orogenies in that region have not completely destroyed an ancient magnetization formed in high-grade Precambrian rocks.

## V

### PUBLICATIONS

Two papers have been accepted for publication in Geophysical Research Letters, April 1982, issue:

R.L. Coles, G.V. Haines, G. Jansen van Beek, A. Nandi, and J.K. Walker.  
Magnetic anomaly maps from 40°N to 83°N derived from Magsat satellite data.

L.R. Newitt, E. Dawson, R.L. Coles, and A. Nandi. Magnetic charts of Canada derived from Magsat data.

An oral presentation was given by R.L. Coles in the session on Geopotential Fields at the NASA Geodynamics Program 4th Annual Meeting, January 1982:

R.L. Coles. Magsat magnetic anomalies at high northern latitudes: some relations to earth structure and dynamics. (abstract was given in Progress Report #4, Dec. 1981).

#### VIII RECOMMENDATIONS

In view of the fact that the mail service does not appear to be reliable, we suggest that notices of acknowledgement of receipt of these Progress reports by the Magsat office be mailed back to the Investigators, to avoid any embarrassment.

#### IX CONCLUSIONS

Correlations between Magsat data and other data sets are suggesting new ideas concerning the evolution and structure of the earth's crust.